Monthly Newsletter on Laser Safety

The Remaining Eye

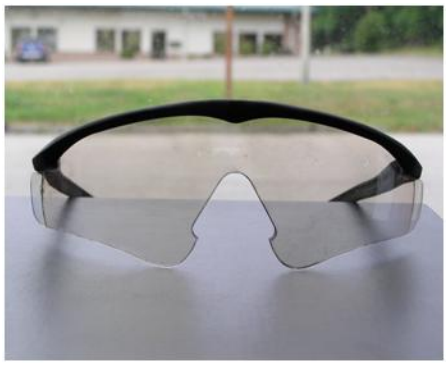
Laser Reference Guide

Just a reminder that the Laser Reference Guide can be found on the Laser Safety Web page through the A-Z index.

Can you guess the lab this cover photo is from? There's a prize if you can.

This Issue

Nano Eyewear



Driven by US military dissatisfaction with the present laser protective eyewear, work is going on to improve laser eyewear, based on nanotechnology. Here are a few elements of that work:

Active medium:

- Novel nano metal oxide particles in a composite texture format

Multiple laser attenuation mechanisms:

- Reflection, scattering, absorption over visible to NIR spectral range with sub-ps response time
- Targeting at OD > 4, VLT > 60%, color neutral, 0.5mJ/cm2 (ns-pulse)/7mW/cm2 (CW) threshold
- All angle protection

Eyewear structure:

- Quasi-solid state structure coated on ballistic-proof lens
- Demonstrated a prototype LEP spectacle made on double curvature ballistic-proof lens
- Synthesized and characterized the baseline optical limiting material, i.e., a quasi-solid-state composite coating containing the nano-particles (NPs)

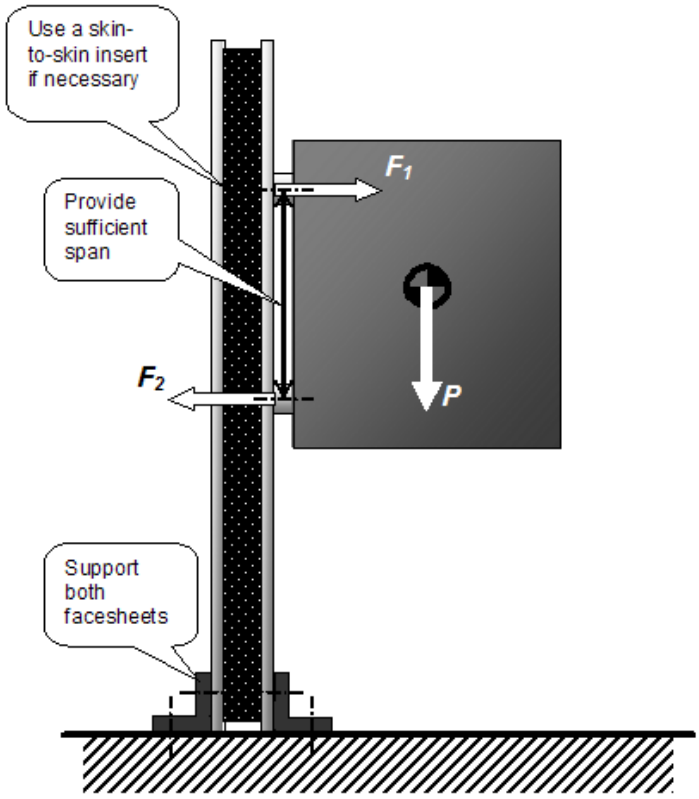
The NP composite coating

- Lowered the optical limiting threshold by 19X as compared to the device made from the same nano-particles but in liquid suspension, reaching to <.7mJ/cm2 at 7ns pulsed at 532nm frequency-doubled Nd:YAG laser wavelength

Increased contrast ratio (CR)

- By 14X as compared to the device made from the same nano-particles but in liquid suspension; reaching CR = 34:1 [optical density (OD) =1.53], and laser damage threshold= 140J/cm2
- Demonstrated the feasibility of achieving sub-100 fs response speed to laser radiation.
- Actual wavelength range achieved, OD 1.53 400-2000nm VLT 60%

Vertical Breadboards: Application Hints



Sometimes it is desirable to put a breadboard in the vertical position. Such a need arises, for example, if two pieces of equipment must be aligned in a vertical plane. Another application is as part of a pick off diagnostics system when table room is hard to come by.

Certain structural safety issues must be addressed when designing the set-ups with vertical breadboards. First of all, mind the general structure of the breadboard. A typical honeycomb breadboard consists of two steel facesheets connected by a lightweight honeycomb core. This produces the excellent stiffness-to-weight ratio that makes these structures so valuable. If a breadboard deflects under an external load, the face sheets are supposed to work mostly in tension/compression, therefore providing the stiffness, and the role of the core is to maintain the distance between the facesheets. It is important to arrange the loading scheme in a way that would ensure the transmission of loads to both facesheets. For a vertical configuration, this means that both front and back facesheets should be supported, as shown in Figure 1. One mode of failure to be safeguarded against is the delamination of the facesheet from the core. Maximum allowable pull-out load per local attachment (shown as F_1 in Figure 1) should be available from the breadboard manufacturer. To limit this load, sufficient span should be arranged between top and bottom attachment points of any heavy equipment with offset center of gravity. In case of a high pull-out load, a skin-to skin threaded insert provides a safe attachment method that prevents the delamination.

Allowable static deflection is defined by the application requirements. Thicker breadboards are preferable in order to limit the deflections. Dynamic deformation, such as vibration, presents a significant concern in many applications. Vertical breadboards tend to vibrate in a cantilever mode with maximum displacement at the top. To limit dynamic response of the set-up, supporting the breadboards at higher elevation, as well as introducing vertical stiffening ribs should be considered. I case of significant loads, a detailed analysis, such as finite-element analysis by a structural engineer, may be necessary.

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EHS Reorganization

The EHS Division has re-organized, with the exception of a few folks like me moving to a new group (Rad Protection), the changes are all new titles and managers moving around. On the organization chart there is now a new layer of managers between Division Director and EHS staff.

2012 Annual ANSI Meeting

The annual laser ANSI meeting took place Feb 16-18, in Orlando, Fl. Major item for our interest is that in the next version of the Z136.1 standard due out near the end of 2012, the Class 4 laser warning sign will no longer say Danger, but Warning. In addition a number of laser product items will be removed from the engineering section.

Science Humor

Darwin Award 2011: (July 2011, New York) Protesting motorcycle helmet laws, an Onondaga, NY man was participating in a bare-noggin protest ride when he was killed via flipping over the handlebars Moreover, hed do it again if he could, according to his elder brother. He would have wanted it that way.

Q: Why do chemists call helium, curium, and barium the medical elements?
A: Because if you can't helium or curium, you barium!

Q: What is the chemical formula for the molecules in candy?
A: Carbon-Holmium-Cobalt-Lanthanum-Tellurium or CHoCoLaTe

Q: What did one uranium-238 nucleus say to the other?
A: "Gotta split!"

Murphy's Ten Laws for Experimentalists: In a scientific experiment,
(1) if something can go wrong, it will do so just before your grant is up for review;
(2) if the reading on your detector is correct, then you have forgot to plug it in;
(3) if several things can go wrong then they will do so all at the same time;
(4) if nothing can go wrong with your experiment, something still will;
(5) left unto itself, your experiment will go from bad to worse; on the other hand, if you pay attention to the experiment then it will take three times longer to complete than you thought it would;
(6) nature is both subtle and malicious (Murphy stole this one from Albert Einstein);
(7) a straight line will never fit your data, and using a wiggly line will result in the rejection by referees of the publication of work;
(8) if you make a great discovery today, you will find a major error in your methods tomorrow (experienced experimentalists call this effect "here today, gone tomorrow");
(9) in contrast to a radio, banging your apparatus when you are at peak frustration will not fix it but permanently break it (for this reason, it is important for experimentalists to remain calm at all times);
(10) when your experiment is just about to succeed, you will run out of grant money.